Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

are brightly pigmented, but the girdle of the chiton is never raised more than a few millimeters from the surface upon which the animal may be resting, and while above water, in the intertidal zone, even this minute elevation occurs only along a short length of the mantle at a time. If it be answered that these chitons frequently creep over one another, it should be remembered that in the Placophora there are no tentacular eyes upon the head, and in the genus *Chiton* no extra pigmental megæsthete eyes upon the valves; so there is, after all, no opportunity for sex-recognition through color (a fantastic idea, for other reasons also). That the coloration of the soft parts is ever visible to other animals seems equally improbable. Certain small isopods (*Sphæroma*) commonly frequent the mantle "chamber" of *Chiton tuberculatus*, but they are found indifferently in the company of either sex. It is necessary to conclude that, so far as *color* is concerned, the pink or orange hue of the body of the female *Chiton tuberculatus* is of no ethological significance; the nature of the pigment, its association with the growing ovary, its progressive changes in the ovary itself, and its presence in the blood, make of this case a most excellent illustration of the "metabolic-accident" conception of certain types of animal coloration.

W. J. CROZIER

DYER ISLAND,
BERMUDA

ON THE ALKALINITY OF THE SEA WATER IN LAGOONS AT BERMUDA[1]

THE present land-form of Bermuda, resembling in certain respects the configuration of many "coral" islands, was employed by Heilprin[2] as an example of atoll formation through basic subsidence. The southeastern segment of the proto-Bermuda land mass, now the only area above water, in addition exhibits three distinct "sounds," or lagoons: Great Sound, Harrington Sound, Castle Harbor. These lagoons Heilprin also conceived to have originated through local subsidences. Fewkes[3] had earlier considered the origin of these lagoons, stating his belief that they, as well as the form of the islands as a whole, were due to the erosive inroads of the sea. The collapse of caves and the general scouring action of tidal and other currents, as subsequently emphasized by Agassiz,[4] rather than very local basal subsidences, were thus regarded as the forces responsible for the lagoons.

---

[1] Contributions from the Bermuda Station for Research, No. 114.

[2] Heilprin, A., 1889, "The Bermuda Islands," Philadelphia, [vi] + 231 pp., 17 pl.

[3] Fewkes, J. W., 1888, *Proc. Bost. Soc. Nat. Hist.*, Vol. 23, pp. 518–522.

So far as the general question of ''coral'' islands is concerned, it is sufficient to note that, strictly speaking, Bermuda is not, of course, a ''coral'' island at all, nor is its form that characteristic of the islands commonly so termed.[5] The problem, however, of this erosive action of the sea, its nature, and its rôle in the determination of land form in the case of a limestone island, is insistently presented by the enclosed lagoons to which I have referred. Murray's idea of the solvent action of natural waters in relation to the hollowing-out of lagoons and to the building of barrier reefs has lately been attacked from several aspects. Thus Mayer[6] has pointed out that at Tutuila (Samoa) and at Oahu, the surface waters draining into the sea are probably too alkaline, and contain too much calcium derived from the land, to be effective in dissolving the shoreward parts of the coral reef-flat. In the case of lagoons, a great number of influences are at work to control the erosion of the rock and the deposition and removal of silt.[7] The measurement of the alkalinity of the lagoon water provides but one of the factors requisite for analysis of the thoroughly heterogeneous equilibrium between the water and the limestone. Such determinations are nevertheless valuable, and during a recent residence at the Bermuda Biological Station I had the opportunity of carrying out estimations of this kind over a period of many months.[8] Attention was chiefly given to the alkalinity of the semi-enclosed waters as compared with that of the open ocean. The determinations were made colorimetrically, by means of thymolsulphonephthalein with borate standards,[9] and phenolphthalein. The alkaline reserve was not estimated.

[4] Agassiz, A., 1895, *Bull. M. C. Z., Harvard Coll.*, Vol. 26, pp. 205–281, 30 pl.

[5] Howe, M. A., 1912, *Science*, N. S., Vol. 35, pp. 837–842. Pirsson, L. V., 1914, *Amer. Jour. Sci.*, Ser. IV, Vol. 38, pp. 189–206.

[6] Mayer, A. G., 1917, *Proc. Nat. Acad. Sci.*, Vol. 3, pp. 522–526.

[7] Crozier, W. J., 1918, *Jour. Exp. Zoöl.*, Vol. 26, pp. 379–389. Mayer, A. G., 1918, Year Book, Carnegie Instn. Wash., for 1917, pp. 186.

[8] Apparatus for this work was obtained by a grant from the C. M. Warren Fund of the American Academy of Arts and Sciences.

[9] McClendon, J. F., Gault, C. C., and Mulholland, S., 1917, Publ. No. 251 Carnegie Instn. Wash., pp. 21–69.

Some distinct indications were had of a seasonal variation in p_H of the enclosed waters, but tidal and other diurnal complications in the lagoons would make it necessary to institute a long series of studies for the complete description of this phenomenon.[10] The general fact was quite apparent that the "inside" water (*i. e.*, water within the sounds) was less alkaline than the "outside" water over the reef flats, the latter likewise less alkaline than the open ocean. Eight sets of estimations gave the p_H of water taken at flood tide just beyond the outermost reefs to the west and northwestward of Bermuda, as 8.25 (21°–23°), at a salinity of 36.4 ± per mille, agreeing with that found by other observers for Atlantic water in this general region. The p^H of the "outside" water was at different times observed to lie between 8.09 and 8.23. Within the sounds, however, the range noted was from 7.95 + to 8.15. The case of Harrington Sound, an almost completely enclosed body of water, is the most interesting. The waters of this lagoon are in communication with the outside sea through but one surface channel, a narrow cut at Flatt's Inlet; there is also a small amount of subterranean communication. Several specific examples will make clear the differences found. The figures refer to samples taken with a tube of pyrex glass from a depth of 2–3 feet below the surface. Samples obtained from depths of several fathoms ran in about the same way.

Sept. 13th, 1917.
Great Sound, 9:40 A.M. Tide ebbing, Water temp. 26.9°; air 27.5° p_H 8.20
North shore, 9:55 A.M. Tide ebbing, Water temp. 26.8°; air 27.8° p_H 8.22
Harrington Sd., 10:55 A.M. Tide ebbing, Water temp. 27.4°; air 27.8° p_H 8.06

Nov. 22d, 1917.
Great Sound, 9:05 A.M. Tide low, Water temp. 19.8°; air 24.0° p_H 8.08
North shore, 9:40 A.M. Tide low, p_H 8.20
Harrington Sd., 10:45 A.M. Tide low, p_H 7.95

Such results obviously speak for the view that the solution of limestone by the sea within such lagoons as Harrington Sound must be reckoned with. Exactly how important a part it plays in the final adjustment of the land form can not, of course, be said. The *color* of the sea water, I might note, varies in correlation with the p^H. Within the sounds, color-readings on the Forel scale[11] averaged 5.5 (17 per cent. yellow), whereas out over the reefs to the northward the color index was 3.9 (8.6 per cent. yellow), that of the ocean beyond the reefs about 3.5 (7 per cent. yellow).

---

[10] *Cf.* Moore, B., Prideaux, E. B. R., and Herdman, G. A., 1915, *Trans. Liverp. Biol. Soc.*, Vol. 29, p. 233. McClendon, J. F., 1918, *Publ.* No. 252, Carnegie Instn. Wash., pp. 213–264.

[11] Steuer, A., 1910, Planktonkunde, xv + 723 pp., 1 Taf. und 365 Abb., Leipzig. [Pp. 84–98.]

W. J. Crozier

Physiological Laboratory,
College of Medicine,
University of Illinois.
June, 1919

A SIMPLE METHOD OF MEASURING THE RATE OF RESPIRATION OF SMALL ORGANISMS

In view of the widespread interest at the present time in the subject of respiration in the lower organisms, it is thought that the following simple method of measuring the rate of carbon dioxide production in small non-aquatic animals and plants may be found useful not only by teachers who desire a quantitative method suitable for class instruction but also by investigators who wish, without any material sacrifice in accuracy, considerably to simplify the various procedures at present followed in making determinations of small amount of CO_2. The apparatus required may readily be constructed by anyone in a few minutes out of materials easily obtainable, and with it, it is possible to measure, with a probable error well within the normal uncontrollable range of variation of the material likely to be studied, a few thousandths of a milligram of carbon dioxide—an amount equal to that given out at ordinary temperatures by a sprouting grain of wheat in perhaps three or four minutes and by a house-fly in one or two minutes. It would be relatively easy still further to increase the delicacy of the method, though the gain in sensitiveness would be at the expense of the simplicity which in its present form is its chief recommendation.

The method is based upon the well known indicator methods of Haas[1] and of Osterhout,[2] but unlike the first, it is applicable to small non-aquatic organisms, and unlike the second, it involves the use of apparatus so simple in construction that it can be duplicated any desired number of times and can therefore be used even by large classes of elementary students. Furthermore, provision is made not only for the comparison of relative rates of carbon dioxide production but also for the measurement of absolute amounts. Simplicity is secured by taking advantage of

---

[1] Haas, A. R., *Science*, 1916, XLIV, 105.

[2] Osterhout, W. J. V., *J. Gen. Physiology*, 1918, I, 17.